

## *Hydrocotyle serendipita* (Araliaceae), a new species of fire ephemeral from south-western Australia

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### Abstract

*Hydrocotyle serendipita* A.J.Perkins *sp. nov.* is a rare species of fire ephemeral from the Albany area of southwest Western Australia. The newly discovered species shares the fire ephemeral life history trait with the recently described *H. phoenix* A.J.Perkins. Based on a suite of vegetative synapomorphies, these two species appear to be closely related. Marked differences in mericarp shape and surface morphology, assist to differentiate the two species. Photographic images of *H. serendipita* are provided, along with a distribution map and a list of diagnostic features to aid in identification.

### Introduction

*Hydrocotyle* L. (Araliaceae) is a morphologically diverse genus of perennial and annual herbs, with some 57 species occurring in Australia (Henwood 2014, CHAH 2017). More than half the Australian species are winter annuals which, in Western Australia, occupy a broad range of habitats, such as wet heath, swamps, damp depressions, margins of inland lakes and moss swards on granite outcrops (Western Australian Herbarium 1998–, Wheeler et al. 2002, CHAH 2017, Perkins 2017a, Perkins 2017b).

Recently, a rare fire ephemeral, *Hydrocotyle phoenix* A.J.Perkins, was discovered and named for the first time in southwest Western Australia, following major summer wildfires in the Northcliffe area (Perkins 2017a). *Hydrocotyle phoenix* is a relatively distinctive annual species, characterised by a basal rosette of fleshy trilobed to pedate leaves with umbellate inflorescences borne on branching, leafy decumbent stems. The surface of the stems, petioles and the abaxial leaf laminae (abaxial) are glaucescent and the carnosose stipules bear distinct marginal cilia. Plants are hispid, with erect white hairs (often with crimson tips) on leaf laminae, petioles and stems. Flowers are borne in umbels subtended by linear involucre bracts which are deflexed with acropetally hooked apices. When the flowers open, all parts of the flowers (including pedicels, ovaries, stamens and petals) are distinctly white in colour. During the early stages of fruit development the mericarps turn light green and the styles crimson. At maturation, the mericarps are deeply chordate, testiculate and hispidulous with fine erect hairs. They then turn light creamy-brown and soon disarticulate

from the pedicels due to a lack of a carpophore. *Hydrocotyle phoenix* is currently known only from one area of Karri forest (and adjoining jarrah forest), where plants grow on dark brown loam soil over granite (Perkins 2017a). At the time of discovery and description, it was believed *H. phoenix* was the only species in the genus to possess a fire ephemeral life history.

In November 2015, wildfires occurred in the coastal granite headland reserves of Torndirrup National Park and Two Peoples Bay Nature Reserve (DPaW 2016), the latter of which has been actively managed for fire exclusion for approximately 50 years (Orr et al. 1995). These significant wildfire events provided an opportunity to monitor the fire response of the vegetation of the granite headlands the following year. During post-fire floristic surveys in November and December 2016, two collections of an annual *Hydrocotyle* were made; one from Torndirrup National Park by (S.Hopper 8702) and another (25 kilometres away) from Two Peoples Bay Nature Reserve (M.L.Dilly 722). Morphological examination of the collections (at the Western Australian Herbarium - PERTH) revealed them to be a new species, most closely similar to *H. phoenix*. Based on the distinctive reproductive morphology of the fertile specimens, *H. serendipita* A.J.Perkins is here described. *Hydrocotyle serendipita* is now the second documented species in the genus *Hydrocotyle* with a fire ephemeral life history.

## Methods

The description of *Hydrocotyle serendipita* is based on the examination of fresh material, photographic images taken of plants *in situ* and two voucher specimens, including the type. Morphological comparisons were made with other Australian species of *Hydrocotyle* held at the Western Australian Herbarium (PERTH). More detailed examination and comparisons were made between the annual species, *H. phoenix* and the perennial species *H. geraniifolia* F.Muell.. A distribution map for *H. serendipita* was produced from voucher specimen data held at PERTH using QGIS Version 2.18.5, and it includes the *Interim Biogeographical Regionalisation for Australia (IBRA) Version 7* boundaries (Department of the Environment 2013).

## Taxonomy

***Hydrocotyle serendipita* A.J.Perkins *sp. nov.***

**Diagnosis:** *Hydrocotyle serendipita* A.J. Perkins is morphologically most similar to *H. phoenix*. Both species are short-lived fire ephemerals, endemic to south-west Western Australia. *Hydrocotyle serendipita* differs from *H. phoenix* by having orbicular schizocarps (testiculate in *H. phoenix*); prominently winged mericarps that are glabrous and laterally flattened between the lateral ribs and dorsal ribs (mericarps lack wings and are hispidulous between the lateral ribs and dorsal ribs in *H. phoenix*); lateral ribs on mericarps prominently raised (0.2–0.3 mm high) and thickened (slightly raised and not thickened in *H. phoenix*); hairs on mericarps restricted to the outer surface of the raised lateral ribs (mericarp surfaces hispidulous except for areas along the lateral and dorsal ribs in *H. phoenix*); and the mericarp surface between the lateral ribs and the commissure distinctly concave and glabrous (this surface is only slightly concave and hispidulous in *H. phoenix*).

**Type:** South of Mount Gardner, Two Peoples Bay Nature Reserve, Western Australia [precise locality withheld for conservation reasons], 14 December 2016, M.L. Dilly 722 (*holo*: PERTH 08842981; *iso*: CANB, NSW).

*Plants* fire ephemeral; 3–10 cm high and 10–50 cm wide, consisting of a basal rosette of 8–25 leaves and branched stems bearing leaves and umbellate inflorescences. *Stems* decumbent, terete, robust, glaucescent and hispid. Hairs erect, white, often with pinkish to crimson tips. *Stipules* 0.8–4.0 mm long, 0.5–1.5 mm wide, ovate to lanceolate to linear lanceolate, opaque, light green to creamy white, often glaucescent, ciliate. Marginal cilia prominent, light cream to white and often with pinkish to crimson tips, 1–4 each side of the stipule and one terminal. *Petioles* (1.5–)10–50 mm long, glaucescent, sparsely covered with erect white hairs (often with pinkish to crimson tips). *Leaves* simple, dorsiventral, predominantly trilobed to pedately lobed in rosette and basal stem-leaves, trilobed to lanceolate in stem-leaves subtending terminal umbels. *Leaf laminae* 6–21 mm long, 6–25 mm wide, discolourous with adaxial surfaces green and abaxial surfaces paler, both surfaces sparsely covered with erect white hairs. Leaf margin toothed, obtuse to acute. Median leaf lobes ovate to obovate, 6–21 mm long, 4–10 mm wide, apex comprising 3 lobules in pedate leaves, the 2 lateral lobules shorter than the median lobule, each lobule with 1–11 teeth. Lateral leaf lobes 3–15 mm long, 2.5–12 mm wide, incised into two or three asymmetrical lobules in pedate leaves, each lobule with 3–13 marginal teeth; leaf sinuses 20–80% of lateral leaflet length. *Inflorescence* a simple umbel, umbels 18–28 flowered; flowers all hermaphrodite, protandrous, 3–8 mm wide. *Peduncles* much longer than subtending stem-leaves at anthesis, 3–35 mm long,



light green and often glaucescent, sparsely covered with erect white hairs. *Involucral bracts* 1.0–2.0 mm long, linear, 8–16 per umbel, deflexed with acropetally hooked apices, white with pinkish to crimson tips. *Flowers* pedicellate; flowering pedicels 0.3–1.0 mm long, terete to subtly longitudinally compressed, cream in colour. *Ovaries* cream to pale creamy green at anthesis. *Calyx* absent. *Corolla* predominantly white with pale pink to crimson colouration on the dorsal surface (towards the apices); petals 5, ovate, 0.5–0.8 mm long, 0.3–0.4 mm wide. *Filaments* white, 0.8–1.0 mm long; anthers white to light cream, 0.4 mm long. *Schizocarps* laterally flattened, orbicular with outer margins becoming winged, deeply cordate at the commissure when wings fully developed, lateral ribs prominent, developing fruit change in colour from cream to light green; fruiting pedicels 1.0–3.0 mm long, light green, colliculate; carpophore absent. *Mericarps* 1.6–2.3 mm wide, 2.0–3.0 mm long; prominently winged and laterally flattened between dorsal and lateral ribs, glabrous; median ribs not raised; lateral ribs prominently thickened and raised, 0.2–0.3 mm high, outer surface of (raised) lateral ribs densely covered with fine patent hairs (0.1–0.2 mm long); surface between lateral ribs and commissure distinctly concave, glabrous; commissure 35–50% the length of mericarps. *Fruiting styles* 0.9–1.2 mm long, fully reflexed, crimson in colour. Mature mericarps turn creamy brown to light brown prior to disarticulation. (Figs 1, 2).

**Other specimens examined: WESTERN AUSTRALIA: WARREN:** One other specimen from the Albany area [precise localities withheld for conservation reasons], Torndirrup National Park 1 Nov 2016, S. Hopper 8702 (PERTH 08901538) (Fig. 3).

**Etymology:** The epithet *serendipita* is derived from the English word ‘serendipity’ and it refers to the unexpected and fortunate discovery of this new species of fire ephemeral from an area of regenerating (post-wildfire) woodland (Fig. 1A), which had previously been unburnt for more than 70 years, near Albany. The common name, ‘Albany Pennywort’ is here suggested.

**Distribution and habitat:** Known from two areas of burnt woodland on slopes below granite peaks in Two Peoples Bay Nature Reserve and Torndirrup National Park (Figs 1A–B, 3). Within Two Peoples Bay Nature Reserve, plants were growing in grey-black sand over granite, located along a steep slope, above what was formerly a densely vegetated gully prior to the wildfire. Plants were growing amongst regenerating *Eucalyptus megacarpa* F.Muell. and *Agonis flexuosa* (Willd.) Sweet, along with *Hakea elliptica* (Sm.) R.Br., *Thomasia discolour* Steud., *Muehlenbeckia adpressa* (Labill.) Meisn., *Rhagodia baccata* (Labill.) Moq. and *Pteridium esculentum* (G.Forst.) Cockayne. Approximately 200 plants were observed at the site, scattered across the slope stretching from the gully creekline up to the base of outcropping granite. At Torndirrup National Park, a small population of approximately ten plants of *H. serendipita* were observed on the south-west side of a granite peak in a west-facing drainage slope in orange-brown sand amongst regenerating *E. megacarpa*, *A. flexuosa*, *Hibbertia furfuracea* (DC.) Benth., *M. adpressa*, *Paraserianthes iophantha* (Willd.) I.C.Nielsen and *Hakea elliptica* seedlings.

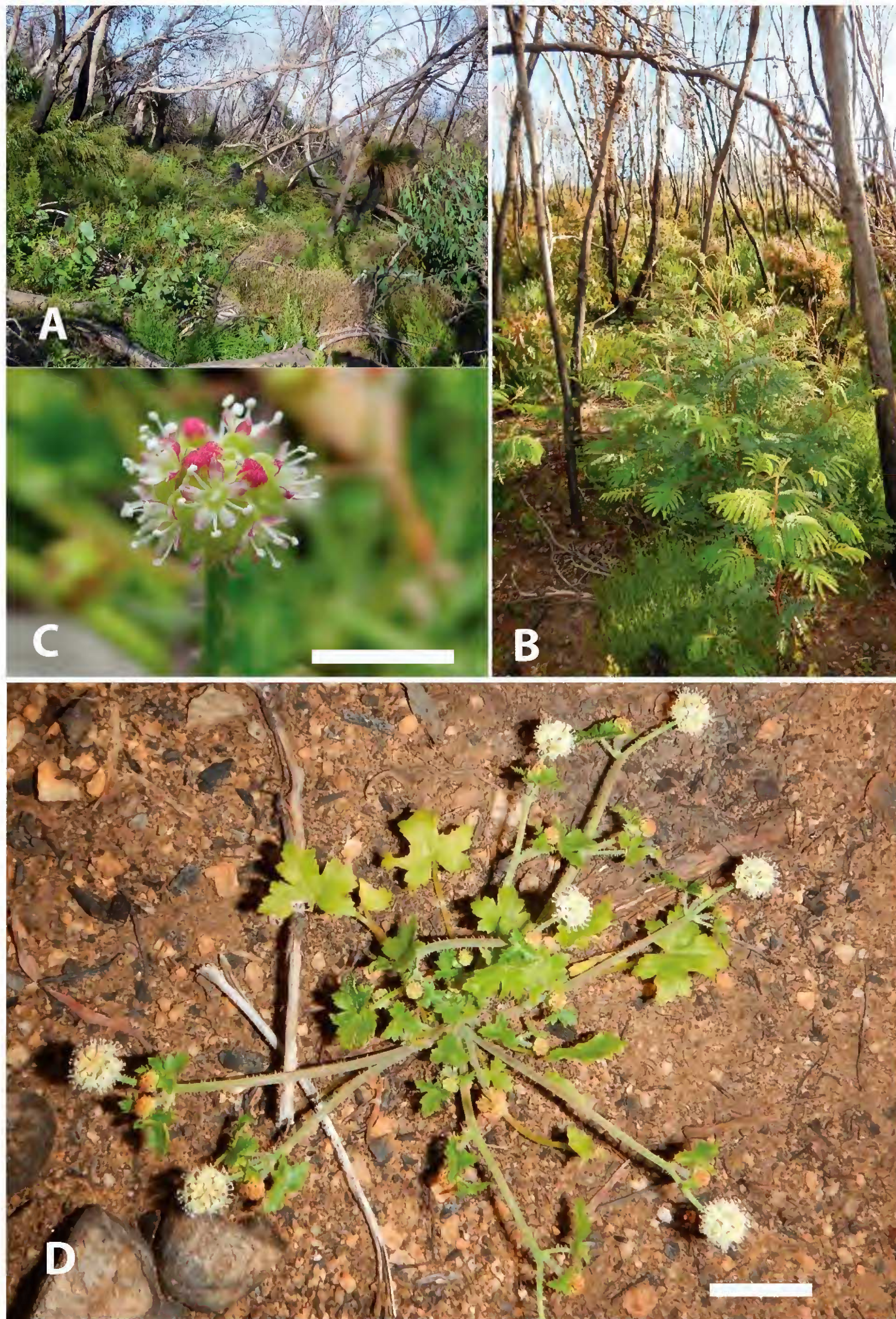
Despite many plant collections from Two Peoples Bay Nature Reserve and Torndirrup National Park (Harvey et al. 1991, Western Australian Herbarium 1998–, CHAH 2017), *H. serendipita* remained undiscovered. This might indicate that it has a localised distribution and is short-lived following a fire event. The Mt Gardner area of Two Peoples Bay, where the plants of *H. serendipita* were growing, had been unburnt for more than 70 years prior to November 2015 (Orr et al. 1995, DPaW 2016). The seeds of this species are likely to be very long-lived, with the species capable of remaining dormant for decades at a time and reappearing with appropriate environmental conditions (such as good autumn and winter rains) following fire.

**Phenology:** Flowering from late October to December. Fruiting from November to January. Plants senesce immediately after the last schizocarps ripen in January.

**Conservation status:** Recommended for listing as Priority Two under Department of Parks and Wildlife Conservation Codes for Western Australian Flora (Smith 2017). *Hydrocotyle serendipita* is geographically restricted, currently only known from two areas (25 km apart) of burnt woodland (near Albany) in Two Peoples Bay Nature Reserve and Torndirrup National Park following post-fire floristic surveys in the spring and early summer of 2016.

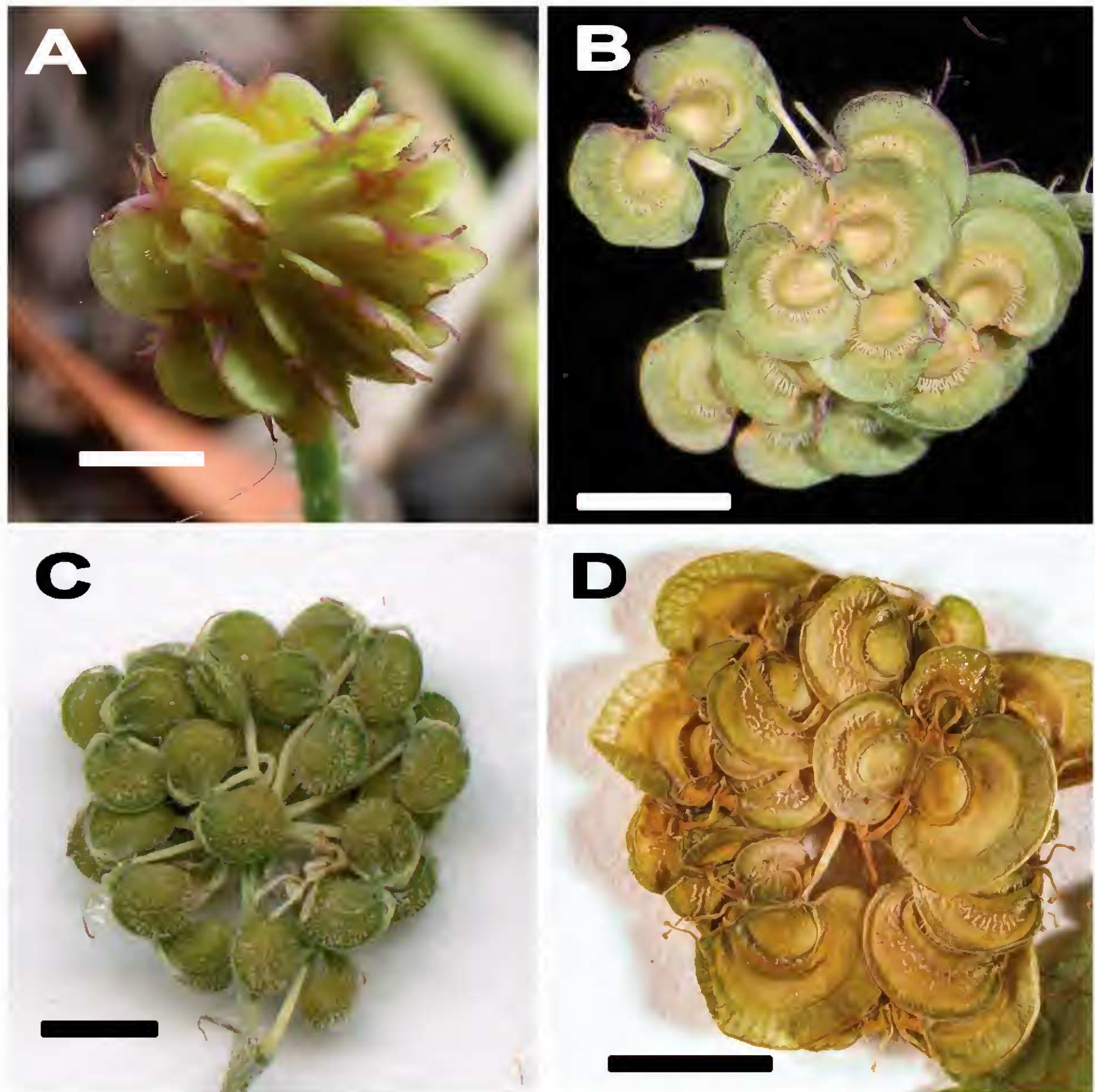
At least ten species of *Hydrocotyle* have been regularly collected or observed in the area since 1802 (*Robert Brown s.n.* - MEL0008112A) (Western Australian Herbarium 1998–, CHAH 2017), but none of *H. serendipita*, indicating the localised nature of this species distribution and the requirement for fires to break seed dormancy. This is only the second species of *Hydrocotyle* with a fire ephemeral life history, indicating the significance of post-wildfire surveys in comparable coastal habitats.





**Fig. 1.** *Hydrocotyle serendipita*: **A.** habitat of *H. serendipita* in burnt woodland at Two Peoples Bay Nature Reserve; **B.** habitat of *H. serendipita* in burnt woodland at Torndirrup National Park; **C.** flowering umbel at anthesis showing white petals with crimson markings on the abaxial surface and tip of the adaxial surface, and laterally flattened ovaries; **D.** habit of fertile plant (Torndirrup National Park). Scale bar: C = 5 mm; D = 20 mm. Images: A & C by M. Dilly; B & D by S. Hopper.

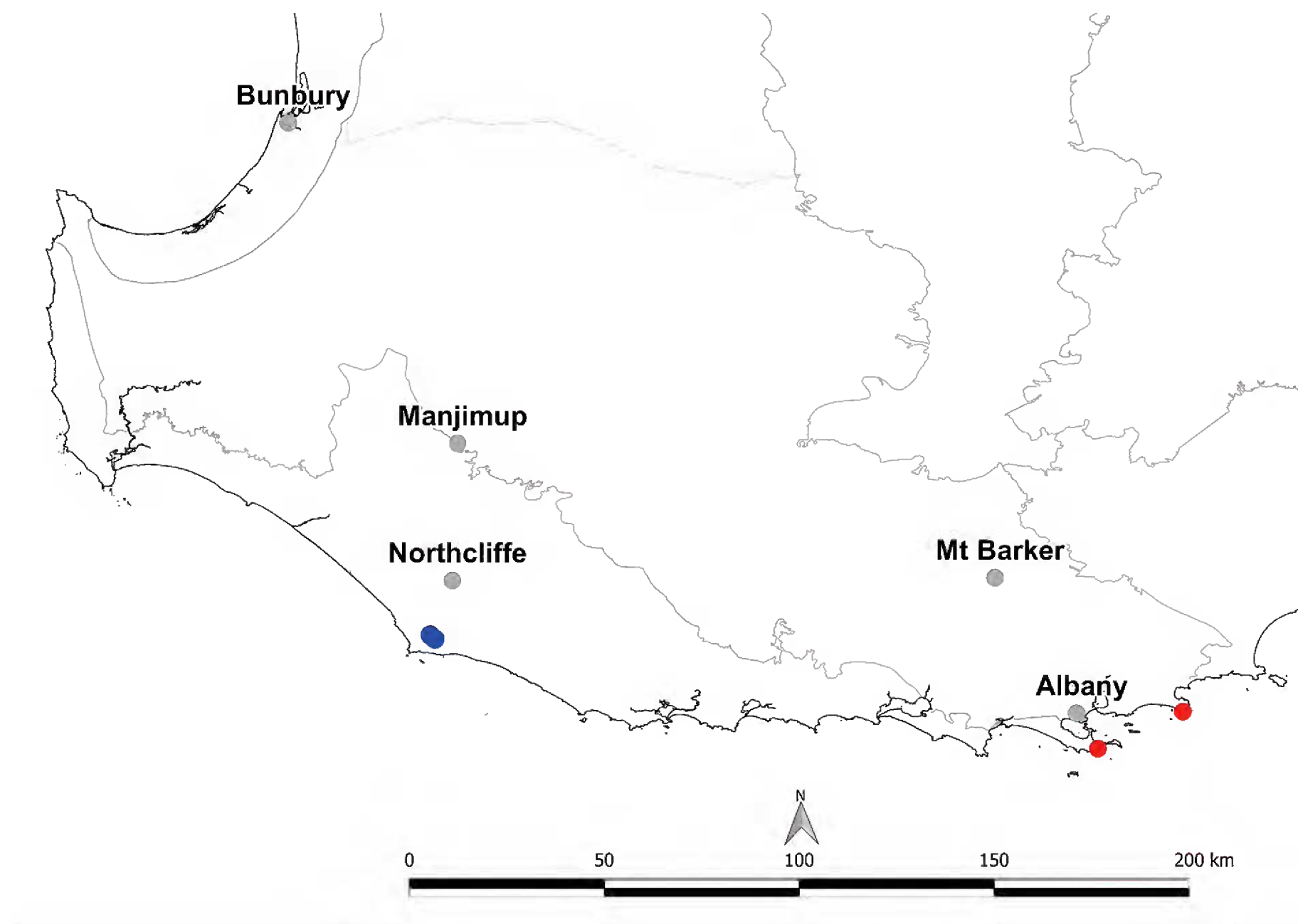




**Fig. 2.** Fruiting umbels: **A.** *Hydrocotyle serendipita*, green fruit nearing maturity showing crimson styles; **B.** *H. serendipita*, mature fruits showing winged mericarps and patent hairs on the outer surface of the raised lateral ribs; **C.** *H. phoenix*, green-coloured fruit nearing maturity showing testiculate, hispid mericarps; **D.** *H. geraniifolia*, mature fruits showing winged mericarps and sparse erect hairs on both sides of the raised lateral ribs. Scale bar: A & C = 2 mm; B & D = 3 mm. Images: A by M. Dilly; B & C by A. Perkins (PERTH 08842981); D by W. Cherry (NSW66216).

**Notes:** A distinctive floral feature observed in *H. serendipita* is the white (to light cream) colouration of the pedicels, ovaries, stamens and petals when the flowers first open. The colour of the flowers change from white to green during the early stages of fruit development. A similar transitional sequence occurs in the flowers of *H. phoenix*. Similar observations have also been made with the perennial *H. geraniifolia*, from eastern Australia (Perkins 2017a). *Hydrocotyle serendipita* (like *H. phoenix*) shares a number of other morphological character traits with *H. geraniifolia*; such as the presence of erect hairs on leaf lamina surfaces, involucral bracts subtending the umbels and glaucescent stems, petioles and peduncles. In addition to these synapomorphies, *H. serendipita* has mericarps morphologically similar to *H. geraniifolia*. Both *H. serendipita* and *H. geraniifolia* have winged mericarps that are laterally flattened between the lateral and dorsal ribs, lateral ribs that are prominently raised, a well-defined concave surface between the lateral ribs and the commissure and hairs on the mericarp surface (Fig. 2B–D).





**Fig. 3.** Map of southwest Western Australia showing the distribution of *Hydrocotyle serendipita* (red dots) and *H. phoenix* (blue dots). *Interim Biogeographic Regionalisation for Australia version 7* bioregions are shown in grey.

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